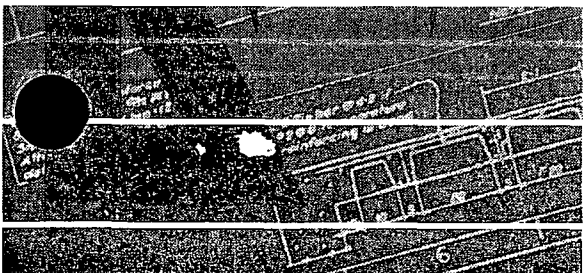
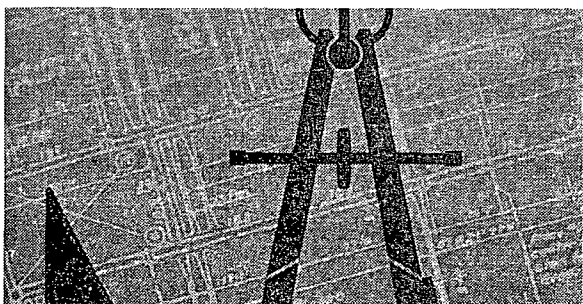
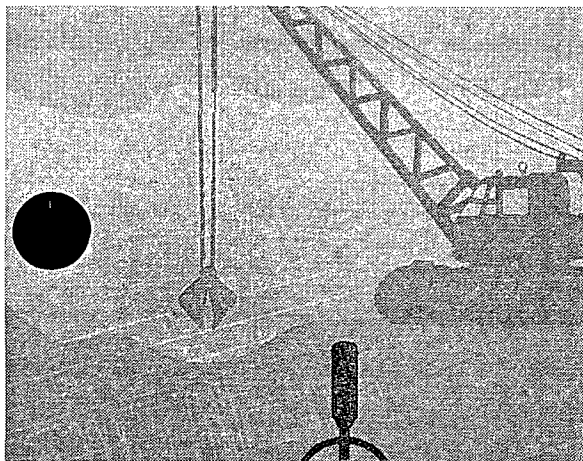


Final Safety Evaluation Report

Related to the Certification of the Advanced
Boiling Water Reactor Design

Supplement 1



U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation

May 1997



AVAILABILITY NOTICE

Availability of Reference Materials Cited in NRC Publications

Most documents cited in NRC publications will be available from one of the following sources:

1. The NRC Public Document Room, 2120 L Street, NW., Lower Level, Washington, DC 20555-0001
2. The Superintendent of Documents, U.S. Government Printing Office, P. O. Box 37082, Washington, DC 20402-9328
3. The National Technical Information Service, Springfield, VA 22161-0002

Although the listing that follows represents the majority of documents cited in NRC publications, it is not intended to be exhaustive.

Referenced documents available for inspection and copying for a fee from the NRC Public Document Room include NRC correspondence and internal NRC memoranda; NRC bulletins, circulars, information notices, inspection and investigation notices; licensee event reports; vendor reports and correspondence; Commission papers; and applicant and licensee documents and correspondence.

The following documents in the NUREG series are available for purchase from the Government Printing Office: formal NRC staff and contractor reports, NRC-sponsored conference proceedings, international agreement reports, grantee reports, and NRC booklets and brochures. Also available are regulatory guides, NRC regulations in the *Code of Federal Regulations*, and *Nuclear Regulatory Commission Issuances*.

Documents available from the National Technical Information Service include NUREG-series reports and technical reports prepared by other Federal agencies and reports prepared by the Atomic Energy Commission, forerunner agency to the Nuclear Regulatory Commission.

Documents available from public and special technical libraries include all open literature items, such as books, journal articles, and transactions. *Federal Register* notices, Federal and State legislation, and congressional reports can usually be obtained from these libraries.

Documents such as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings are available for purchase from the organization sponsoring the publication cited.

Single copies of NRC draft reports are available free, to the extent of supply, upon written request to the Office of Administration, Distribution and Mail Services Section, U.S. Nuclear Regulatory Commission, Washington DC 20555-0001.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at the NRC Library, Two White Flint North, 11545 Rockville Pike, Rockville, MD 20852-2738, for use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from the American National Standards Institute, 1430 Broadway, New York, NY 10018-3308.

Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design

Manuscript Completed: April 1997
Date Published: May 1997

**Division of Reactor Program Management
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001**





ABSTRACT

This report supplements the final safety evaluation report (FSER) for the U.S. Advanced Boiling Water Reactor (ABWR) standard design. The FSER was issued by the U.S. Nuclear Regulatory Commission (NRC) staff as NUREG-1503 in July 1994 to document the NRC staff's review of the U.S. ABWR design. The U.S. ABWR design was submitted by GE Nuclear Energy (GE) in accordance with the procedures of Subpart B to Part 52 of Title 10 of the Code of Federal Regulations. This supplement documents the NRC staff's review of the changes to the U.S. ABWR design documentation since the issuance of the FSER. GE made these changes primarily as a result of first-of-a-kind-engineering (FOAKE) and as a result of the design certification rulemaking for the ABWR design. On the basis of its evaluation, the NRC staff concludes that the confirmatory issues in NUREG-1503 are resolved, that the changes to the ABWR design documentation are acceptable, and that GE's application for design certification meets the requirements of Subpart B to 10 CFR Part 52 that are applicable and technically relevant to the U.S. ABWR design.

CONTENTS

	Page
ABSTRACT	iii
1 INTRODUCTION AND GENERAL DISCUSSION	1-1
1.1 Introduction	1-1
1.2 General Design Description	1-1
1.2.2 Precertification and Postcertification Design Control Procedures	1-1
1.5 Summary Of Principal Review Matters	1-2
1.6 Index of Applicable Regulations and Exemptions	1-2
1.7 Index of Tier 2* Information	1-2
1.8 Index of Confirmatory Items	1-3
3 DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS	3-1
3.8 Design of Seismic Category I Structures	3-1
4 REACTOR	4-1
4.6 Functional Design of Fine Motion Control Rod Drive System	4-1
5 REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS	5-1
5.4.6 Reactor Core Isolation Cooling System (RCIC)	5-1
9 AUXILIARY SYSTEMS	9-1
9.2 Water Systems	9-1
9.4 Heating, Ventilating, and Air Conditioning Systems	9-1
12 RADIATION PROTECTION	12-1
12.3 Radiation Protection Design	12-1
14 INITIAL TEST PROGRAM	14-1
14.3 Certified Design Material	14-1
14.3.7.5 Reliability Assurance Program	14-1
15 TRANSIENT AND ACCIDENT ANALYSES	15-1
15.4 Radiological Consequences of Accidents	15-1
16 TECHNICAL SPECIFICATIONS	16-1
19 SEVERE ACCIDENTS	19-1
20 GENERIC ISSUES	20-1
20.5 10 CFR 50.34(f), Additional TMI Requirements	20-1
20.5.1.3 Identification of Potential Design Improvements	20-1
21 REPORT OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS	21-1
22 CONCLUSION	22-1
Appendix C CONTINUATION OF CHRONOLOGY OF CORRESPONDENCE	C-1
Appendix D CONTRIBUTORS TO THIS FSER SUPPLEMENT	D-1
Appendix L ERRATA TO THE ABWR FSER	L-1



1 INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This report supplements the final safety evaluation report (FSER) for the U.S. Advanced Boiling Water Reactor (ABWR) standard design. The FSER was issued by the U.S. Nuclear Regulatory Commission (NRC) staff as NUREG-1503 in July 1994 to document the NRC staff's review of the ABWR design. This supplement documents the NRC staff's review of the changes to the ABWR design documentation since the issuance of the FSER. GE made these changes primarily as a result of first-of-a-kind-engineering (FOAKE) and as part of the design certification rulemaking for the ABWR design. Specifically, this supplement documents the resolution of confirmatory items in the FSER relating to the preparation of the Design Control Document (DCD); it provides an evaluation of changes to the ABWR design made as part of FOAKE; it provides an additional evaluation of radiological release information not included in the FSER; and it provides errata to the FSER.

GE Nuclear Energy (GE, the applicant) submitted the ABWR design documentation under Subpart B of Part 52 of Title 10 of the Code of Federal Regulations. The documentation and information pertaining to this supplement were submitted on Docket No. 52-001. The ABWR design documentation includes the standard safety analysis report (SSAR), certified design material (CDM), and the DCD.

Each of the following sections or appendices of this supplement is numbered and titled the same as the section or appendix of the FSER that is being updated. The discussions are supplementary to and not in lieu of the discussion in the FSER unless otherwise noted. Accordingly, Appendix C is a continuation of the chronology of correspondence for the review, Appendix D is a list of principal contributors to this supplement, and Appendix L contains errata to the FSER. No significant changes were made to FSER Appendices A, B, E, F, G, H, I, J, and K by this supplement.

This supplement is issued by the Standardization Project Directorate in the Office of Nuclear Reactor Regulation. The NRC's licensing project manager for the U.S. ABWR design is Dino C. Scaletti. He may be reached by calling (301) 415-1104, or by writing to the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Copies of the ABWR design documentation and all amendments and revisions are available for public inspection at the NRC's Public Document Room, 2120 L Street NW. (Lower Level), Washington, DC. Copies of the ABWR FSER and this supplement are also available at the NRC's Public Document Room.

1.2 General Design Description

1.2.2 Precertification and Postcertification Design Control Procedures

GE coordinated certain design issues with its international associates that affected the ABWR design being built in Japan using a system of common engineering documents (CEDs). Design changes identified in CEDs were maintained by GE in a controlled list for future action called the Design Action List (DAL). GE intended to incorporate the items on the DAL into the supporting documentation for the U.S. ABWR design as part of its ongoing design activities.

In the FSER, the staff stated that GE must certify to the NRC that the U.S. ABWR DCD was not affected by any changes to the ABWR CEDs. This was based on a GE letter of June 11, 1993, stating that, after completing the DCD, GE would certify that the Tier 1 and Tier 2 information had not been affected by any subsequent changes made in the CEDs since the final Tier 1 and Tier 2 submittals. This was FSER Confirmatory Item F1.2.2-1.

In a letter of December 22, 1994, GE certified that the information in the DCD had not been affected by any changes in the CEDs since the final submittals of the SSAR and CDM. GE further stated in a letter of January 26, 1995, that all pertinent information from the DAL and CEDs had been incorporated in Revision 2 of the DCD for the ABWR design. This is acceptable and resolved FSER Confirmatory Item F1.2.2-1.

In the FSER, the staff stated that GE must give the staff a list of the ABWR CEDs and the DAL that applied to the U.S. ABWR design and their effective dates. In a letter of June 11, 1993, GE stated that, after completing the DCD, it would finalize the DAL and submit the corresponding effective dates of CEDs and the DAL. This was Confirmatory Item F1.2.2-2.

In a letter of January 26, 1995, GE described the design configuration supporting the most current DCD revision for design certification (DCD Revision 2). Further, GE stated that it maintains a Master Parts List (MPL) of record that contains a complete list of all ABWR certification documents, including CEDs and the DAL, thereby maintaining records of the documents supporting the design certification. For future design efforts, GE will follow procedures to control the detailed design work to ensure conformance with the DCD. Therefore, although the design documentation supporting the design may change, these changes are traceable and provide the ability to retrieve the design documentation supporting the design certification.

This is acceptable and resolved FSER Confirmatory Item F1.2.2-2.

The staff issued a notice of proposed rulemaking for the ABWR design certification in the Federal Register that incorporated DCD Revision 2 by reference. Subsequently, GE submitted additional changes to the ABWR design, as discussed in Section 1.5 of this supplement. Therefore, in a letter dated June 10, 1996, GE confirmed that the MPL continued to define the design documentation implementing the NRC-approved design, including the CEDs and the DAL. This is acceptable.

1.5 Summary of Principal Review Matters

GE prepared the CDM and SSAR as part of its design certification application for the U.S. ABWR standard design. The NRC staff provided its evaluation of the design in the FSER (NUREG-1503). Subsequently, GE prepared a separate document called the Design Control Document (DCD) to be incorporated by reference into the ABWR design certification rule. The DCD has two tiers of information that were derived from and include most of the information in the CDM and the SSAR.

The staff stated in the FSER that, after issuance of the FSER, the applicant for design certification will submit a DCD for the staff's review. This was Confirmatory Item F1.5-1. GE submitted Revision 0 of the DCD on October 28, 1994. In general, GE followed the NRC staff guidance in letters of August 26, 1993 and August 3, 1994 regarding the format of the DCD. The staff provided comments on the DCD, and GE addressed all of the NRC staff comments in DCD Revisions 1 and 2. This is acceptable and resolved FSER Confirmatory Item F1.5-1.

DCD Revision 2 was the last revision the NRC received before issuing the notice of proposed rulemaking for the ABWR design in the Federal Register on April 7, 1995. Subsequently, GE proposed additional changes to the ABWR design documentation resulting from detailed design work in FOAKE. These proposed changes were documented in a letter dated April 16, 1996, a meeting summary dated May 8, 1996, and a letter dated June 10, 1996. GE provided a revised submittal on July 1, 1996. The staff's review of these changes is set forth in the appropriate sections of this supplemental FSER.

GE submitted Revision 3 to the DCD, Revision 3, on August 30, 1996. Revision 3 incorporated the changes documented in its letters of June 10 and July 1, 1996. GE also submitted SSAR Amendment 37 (Revision 9) and CDM Revision 8 on August 30, 1996, to make these documents consistent with Revision 3 to the DCD. However, some differences between the DCD and the SSAR/CDM remained that GE documented in its letter of August 30, 1996. These differences include designation of Tier 2* information in the DCD (refer to

Section 1.7 below); proprietary information in the SSAR that was not included in the DCD (refer to SSAR proprietary volumes); safeguards information in the SSAR that was not included in the DCD (refer to SSAR Section 13.6); and detailed probabilistic risk assessment (PRA) information in the SSAR that was not included in the DCD. The treatment of these issues is described in the ABWR design certification rule and the statements of consideration (SOC) and are, therefore, not discussed in this supplement. For further information, see the final rule and the SOC section-by-section discussion for Section IV, "Additional Requirements and Restrictions."

GE submitted Revision 4 to the DCD on March 28, 1997. This revision includes changes, such as the DCD introduction, that were made to conform the ABWR DCD with the final design certification rule. This version of the ABWR DCD is approved by this supplement to the ABWR FSER and is the version that will be incorporated by reference into the final design certification rule for the U.S. ABWR standard design.

1.6 Index of Applicable Regulations and Exemptions

In the FSER, the NRC staff identified new standards for selected technical and severe accident issues for the U.S. ABWR design that were addressed and resolved during the design certification review. These new design standards were consequently included as additional applicable regulations in the proposed rule for the purposes of 10 CFR 52.48, 52.54, 52.59, and 52.63. The Commission decided not to codify the additional applicable regulations in the final rule, but the Commission did set forth its intent with regard to these new design standards in its SOC for the final design certification rule (See the SOC public comment summary and resolution section on the need for additional applicable regulations).

1.7 Index of Tier 2* Information

In the FSER, the staff stated that any changes to certain SSAR commitments would require prior NRC approval before the change was implemented by a COL applicant or licensee who referenced the ABWR certified design. The staff listed these SSAR commitments in the FSER, and required that they be identified in the DCD as "Tier 2*" information. This was FSER Confirmatory Item F1.7-1.

GE identified the Tier 2* information in the appropriate sections of the DCD, although GE did not designate this information in the SSAR. The staff did not require the designation in the SSAR because the Tier 2* information

was described in the staff's FSER. This is acceptable and resolved FSER Confirmatory Item F1.7-1.

In various locations in the FSER, the staff stated that any changes to Tier 2* information would involve an unreviewed safety question (USQ) and, therefore, require NRC review and approval prior to implementation. This statement regarding USQs was used simply to indicate that the change process for Tier 2* information would be the same as that for proposed changes to other Tier 2 information that is determined by an applicant or licensee to be a USQ. However, a determination of whether or not a proposed change to the Tier 2* information would constitute a USQ has not been made by the NRC, and the actual process for changing Tier 2* information is described in the final design certification rule. Therefore, the language in the FSER has been modified to conform with the language of the final rule and its SOC (See the rule and the SOC section-by-section analysis regarding the processes for changes and departures, and the SOC public comment summary and resolution section regarding the Tier 2 change process) by the errata in Appendix L to this supplement.

1.8 Index of Confirmatory Items

Section 1.8 of the FSER listed a total of five confirmatory issues. The FSER stated that these items would be resolved during the staff's review of the ABWR design control document. In the FSER, each confirmatory item was assigned a unique number that identified the section of the FSER where the item was discussed. This number was listed in parentheses. For example, Confirmatory Item F1.5-1 was discussed in Section 1.5 of the FSER. All of these issues have been resolved as discussed in the corresponding sections of this report.

<u>Item Number</u>	<u>Description of Item</u>
F1.2.2-1	Certification that the DCD was not affected by changes to CEDs
F1.2.2-2	Submittal of a list of CEDs and DALs
F1.5-1	Submittal of DCD
F1.7-1	Identify Tier 2* information
F14.3.7.5-1	Reliability Assurance Program



3 DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

3.8 Design of Seismic Category I Structures

GE proposed changing the DCD to use higher strength materials for the submerged portions of the lower drywell access tunnels and reactor pressure vessel (RPV) pedestal. The submerged portions will be clad with stainless steel to improve the corrosion resistance of the materials. GE determined that the changes were necessary based on considerations for the ability to clad and the strength to withstand high thermal stresses. The submerged portion of the RPV pedestal shell required a stainless steel clad and the A572 material specified in the DCD was not suitable for cladding. The access tunnel shells must withstand a high thermal stress as predicted by detailed structural analyses and the A516 material specified in the DCD had a relatively low yield strength at room temperature. GE proposed ASTM A533, Type B, Class 2 material for the clad portions of the RPV pedestal and lower drywell access tunnels. This material is a fully killed steel, which has very good cladding properties and high strength. Therefore, the NRC staff found these changes to be acceptable because the properties of the proposed material are suitable for the intended application.



4 REACTOR

4.6 Functional Design of Fine Motion Control Rod Drive System

GE submitted a change to increase the design pressure of the fine motion control rod drive (FMCRD) scram piping, based on tests and evaluations of water hammer effects.

The changes are consistent with the ASME Code, which requires the use of equipment events rather than plant events in determining the design pressure. The NRC staff reviewed the change and found it to be acceptable.



5 REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS

5.4.6 Reactor Core Isolation Cooling System (RCIC)

GE submitted a change to delete the rupture disks that were originally intended to protect the low pressure exhaust side of the RCIC turbine case and exhaust line from over pressurization. GE determined that the rupture discs created the potential for an interfacing systems LOCA if the system were subjected to an over pressure situation. This potential would be counter to the purpose for the previous upgrade of the RCIC turbine exhaust system to withstand maximum system pressure. Therefore, GE removed the rupture disks from the design to reduce the potential for a LOCA in the turbine exhaust system. The NRC staff finds this change to be acceptable because it does not change the findings in the FSER.



9 AUXILIARY SYSTEMS

9.2 Water Systems

GE determined that the federally mandated phaseout of several commonly used refrigerants required the following design changes: (1) changing the description of the chillers for the Heating, Ventilating, and Air Conditioning (HVAC) Emergency Cooling Water System so that either a centrifugal or positive displacement type pump could be used in the system; (2) changing the description of the Reactor Building Cooling Water (RCW) heat exchangers so that either a shell and tube or plate type heat exchanger could be used in the system; and (3) lowering the ultimate heat sink (UHS) design temperature from 37.8 °C (100 °F) to 35 °C (95 °F). GE submitted these changes to the ABWR design documentation as part of its DCD Revisions 0, 1, and 2. The staff reviewed the above changes made in the ABWR design documentation and determined that the changes to the heat exchangers and refrigeration systems were not safety significant because they did not affect the performance requirements of the systems. Further, the staff had based its safety evaluation in the FSER on a UHS temperature of 95 °F, thus bounding the UHS design temperature change. Some changes to the FSER are contained in the errata in Appendix L to this supplement. Therefore, although the above changes affect background discussions in the FSER, the staff concludes that none of them affect the fundamental safety decisions in the FSER.

Subsequently, GE submitted the following additional change resulting from its first-of-a-kind-engineering (FOAKE) work and included it in the final DCD. GE provided an additional chiller/pump set for Division A of the HVAC Emergency Cooling Water (HECW) System. The change provided functional redundancy to avoid the loss of cooling to safety-related electrical equipment area HVAC systems for the control building and reactor building (which could potentially challenge electrical equipment environmental qualification temperature limits), and satisfied system maintenance needs. Consistent with Divisions B and C, an additional chiller/pump set for Division A of the HECW System provided for the performance of chiller/pump on-line maintenance, whereby a controlled environment can be sustained in Class 1E equipment rooms in Division A of the reactor building and control building. The staff concludes that the change is a design improvement that enhances system reliability and maintainability, did not change the fundamental safety decisions in the FSER, and is acceptable.

9.4 Heating, Ventilating, and Air Conditioning Systems

GE modified the Reactor Building and Radwaste Building HVAC systems to improve system reliability and maintainability. Specifically, GE used electric heating in place of hot water heating to protect against freezing in the pipes of the hot water system during adverse outside environmental conditions for the Reactor Building secondary containment and Radwaste Building HVAC systems. This also eliminated the relatively large hot water piping that was routed from the reactor building to the turbine building and back. GE also split the secondary containment HVAC system air intake into three 50-percent air handling units, thereby providing redundancy to enhance system reliability and facilitate system maintenance. Further, GE used high efficiency filters in place of medium grade bag-type filters to provide additional filtering capability and reduce maintenance problems associated with bag-type filters. The staff concludes that the changes are design improvements that enhance the system reliability and maintainability, did not affect the fundamental safety decisions in the FSER, and are acceptable.

GE modified the control building and reactor building safety-related HVAC systems to change the smoke removal methods, replaced centrifugal fans with vane axial fans, and switched divisional power supply to the fine motion control rod drive (FMCRD) panel rooms. The first change provided positive exhaust ventilation rather than pressurization for smoke removal from the areas served by the HVAC systems. A dedicated smoke removal fan was added to the reactor building safety-related electrical equipment (SREE) HVAC system. In addition, both exhaust fans in the control room habitability area (CRHA) and control building safety-related equipment area (CBSREA) HVAC systems are activated for smoke removal. Finally, the reconfiguration of duct work arrangements in the control building HVAC systems and reactor building SREE HVAC system provides a single cross-connect from the return to the exhaust duct work, except that the diesel generator, day tank, chiller, and battery rooms in the above systems exhaust directly to the outside atmosphere. For the second change, the centrifugal exhaust fans were replaced with 2-speed vane axial fans and centrifugal supply fans were replaced with single speed vane axial fans in the CRHA system for space conservation. Also, the centrifugal supply and exhaust fans were replaced with single speed vane axial fans in the CBSREA system. Finally, the distribution of the cooling loads were balanced by assigning FMCRD panel rooms to Divisions A and B. The NRC staff concludes that the design changes enhanced the system functions, and did

not affect the fundamental safety decisions in the FSER. Therefore, the changes are acceptable.

GE reassigned the main control room HVAC exhaust fans according to their respective divisional space. The changes reassigned the main control room HVAC exhaust fans ("B" as "C" and "C" as "B") according to their respective divisional space to eliminate the potential divisional cross-over of cooling water and power, to enhance exhaust fan performance due to less complexity in duct work, and to eliminate potential for breaching fire barriers and fire proofing the duct work. The staff concludes that the changes are design improvements that enhance the systems reliability and maintainability, did not affect the fundamental safety decisions in the FSER, and are acceptable.

GE corrected various inconsistencies between Tier 1 and Tier 2 of the DCD in the reactor building secondary containment HVAC and reactor building non-safety-related equipment HVAC systems. The NRC staff concludes that the changes ensure that the design documentation more accurately represents the design, did not affect the fundamental safety decisions in the FSER, and are acceptable.

GE modified the CRHA HVAC system to provide two independent Class 1E power sources for each pair of boundary isolation dampers, except for the motor-operated isolation dampers which are designed to fail as-is. GE also added a cross-tie in Tier 1 between the two inlet ducts of emergency filtration unit in each division. The changes assure the necessary alignment of dampers and prevents the infiltration of unfiltered in-leakage during a design basis accident and loss of one division of power. The NRC staff concludes that the changes meet SRP Section 9.4 regarding single failure criteria and are, therefore, acceptable.

12 RADIATION PROTECTION

12.3 Radiation Protection Design

GE submitted changes to the reactor building radiation zone maps in the DCD. The changes involved minor detailed aspects of the drawings. The NRC staff finds these changes acceptable because they do not change the findings in the FSER.



14 INITIAL TEST PROGRAM

14.3 Certified Design Material

14.3.7.5 Reliability Assurance Program

In the FSER, the NRC staff required a high-level commitment to a reliability assurance program in the design documentation. GE committed to provide the required information in a letter dated July 12, 1994. This was FSER Confirmatory Item 14.3.7.5-1. GE provided the required information in a modification package to the SSAR and CDM on July 20, 1994, and also included this information in the DCD. This is acceptable and resolved FSER Confirmatory Item F14.3.7.5-1.



15 TRANSIENT AND ACCIDENT ANALYSES

15.4 Radiological Consequences of Accidents

Several tables in Section 15.4 of the FSER inadvertently contained incorrect values that were used in the radiological analyses for the ABWR design. These values have been corrected as part of the errata in Appendix L of this supplement.

Subsequent to issuance of the FSER in July 1994, GE changed the ABWR control room ventilation and filtration system design as reflected in the revisions to FSER Table 15.9. These changes resulted in a decrease in the control room filtered air intake; an increase in the intake filter efficacy; an increase in charcoal adsorber iodine removal efficiency; and a reduced rate of filtered air recirculation flow. These changes have been incorporated into the SSAR and the DCD. The NRC staff has reviewed these design changes using similar methodology as that described in FSER Section 15.4, and finds that the changes result in lower radiation doses to control room personnel than previously calculated. The revised Chi/Qs are reflected in the errata in Appendix L to this supplement. Therefore, the NRC staff concludes that the design changes do not alter the conclusions reached in FSER Section 15.4 and in FSER Section 6.4, "Control Room Habitability Systems," and are acceptable.



16 TECHNICAL SPECIFICATIONS

GE modified the technical specifications (TS) by changing the location for temperature measurement from the average RSW temperature to the permanently installed temperature elements in the reactor service water (RSW) system at the inlet piping to the heat exchangers for the reactor building cooling water system. Additionally, the TS temperature limit was reduced to 33.3 °C to provide sufficient operating margin to ensure that the RSW inlet temperature did not exceed the 35 °C assumed for the loss of coolant design basis accident. The TS temperature is sufficiently above the expected maximum normal operation RSW inlet temperature of 32.8 °C to minimize the potential of reaching the TS limit during normal operation. Also, GE modified the surveillance frequency for testing the set points of safety relief valves from 18 months to that specified in the Inservice Testing program, consistent with the BWR standard TS. The NRC staff concludes that the changes ensure system performance, meet the requirements of 10 CFR 50.34 and 50.36 for technical specifications for the design, and are acceptable.



19 SEVERE ACCIDENTS

GE submitted changes to the DCD to make the probabilistic risk assessment (PRA) and severe accident analyses more accurately reflect the approved design. The changes were primarily to (1) correct the description of the emergency diesel generator and combustion turbine generator load carrying capabilities, (2) correct discussions of the turbine service water isolation features, and (3) update the seismic margins analysis. The NRC staff reviewed the changes to Chapter 19 and concludes that none of the changes significantly affected the PRA or severe accident analyses or results and, therefore, do not change the fundamental safety decisions in the FSER. The NRC staff also modified its FSER to reflect the revised descriptions in the DCD as part of the errata in Appendix L to this supplement.



20 GENERIC ISSUES

20.5 10 CFR 50.34(f), Additional TMI Requirements

20.5.1.3 Identification of Potential Design Improvements

The numerical values and discussion in this FSER section were based on the values in Section 19P of the SSAR. As part of the design certification rulemaking, GE updated SSAR Section 19P, but did not include it in the DCD. Instead, GE relocated it to GE's "Technical Support Document (TSD) for the ABWR", Revision 1, December 1994, which was contained in an attachment to a letter from GE to the NRC dated December 21, 1994. In the errata in Appendix L to this supplement, the staff updated the FSER to correspond to the latest information in the TSD. Also, the discussion in this supplement conforms with the final environmental assessment issued with the design certification rule, and is based on the updated information in the TSD.

In the FSER, the NRC staff utilized a value of \$1,000/person-cSv (\$1000/person-rem) averted to estimate that a design improvement that cost more than \$200,000 would not be cost-beneficial. This figure conservatively assumed that the total 60-year lifetime risk for the ABWR was eliminated by the design improvement (200 person-cSv averted risk \times \$1,000/person-cSv = \$200,000). Since the FSER was issued, the NRC issued "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission" (NUREG/BR-0058, Revision 2, November 1995). This guidance document adopted a \$2,000/person-cSv (\$2000/person-rem) conversion factor, subject to present worth considerations, and is limited in scope to health effects. Limiting the conversion factor solely to health effects required that the regulatory analysis include an additional dollar allowance for averted offsite property damage.

The NRC staff reviewed the design alternatives identified in the TSD using \$2,000/person-cSv averted for health effects and adopting a \$3,000/person-cSv supplemental allowance for offsite property (See NUREG/CR-6349, "Cost benefit Considerations in Regulatory Analysis"). Assuming a base case 7% real discount rate as prescribed in NUREG/BR-0058, Revision 2, the present value of the health and safety benefits attributable to a cost-beneficial design improvement would approximate \$233,000. This is a factor of about 1.2 times higher than the \$200,000 estimate identified in the FSER. A comparable estimate for the health and safety benefits of a cost-beneficial design modification based on a 3% real discount rate, which is recommended for sensitivity analysis purposes, is \$460,000, or 2.3 times greater than the \$200,000 estimate in the FSER.

Most of the candidate design alternatives in the TSD were estimated to cost more than \$460,000 and, therefore, were not cost-beneficial. Of the design alternatives that cost less than \$460,000, the drywell head floodor was the most cost-beneficial design modification (\$1.7 million/person-cSv averted), as shown in Table 20.5.1-3 of the FSER. However, given that the drywell head floodor was estimated to cost on the order of \$100,000, under either the 7% or 3% discount rate scenario, this design alternative would have to eliminate at least 43% or 22%, respectively, of the total lifetime risk. Since the drywell head floodor was estimated to only account for less than 10% of the total risk, even for this most cost-beneficial design modification, the total costs continued to be well in excess of the total benefits.

In summary, the NRC staff concludes that with the significant margins in the results of the cost-benefit analysis, consideration of severe accident design alternatives using the new values provided in NUREG/BR-0058 do not change the findings in the previous analysis in the FSER.



21 REPORT OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The Advisory Committee on Reactor Safeguards considered the information discussed in this supplement to the ABWR FSER during their 433rd meeting on August 8, 1996, and subsequently issued its letter on August 15, 1996. The letter, which follows, reflects approval of the application for design certification and includes no recommended actions for either the NRC staff or GE Nuclear Energy.



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

August 15, 1996

The Honorable Shirley Ann Jackson
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Chairman Jackson:

SUBJECT: DESIGN CHANGES PROPOSED BY GENERAL ELECTRIC NUCLEAR ENERGY RELATING TO
THE CERTIFICATION OF THE U.S. ADVANCED BOILING WATER REACTOR DESIGN

During the 433rd meeting of the Advisory Committee on Reactor Safeguards, August 8-10, 1996, we reviewed recent design changes proposed by General Electric Nuclear Energy (GENE) relating to the certification of the U.S. advanced boiling-water reactor (ABWR) design. These "design changes" consist of both actual modifications to the design and corrections to the documentation to remove inconsistencies and typographical errors. We had the benefit of discussions with representatives of the NRC staff and of GENE. We also had the benefit of the documents referenced.

Conclusions

Our review of Supplement 1 to NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the U.S. ABWR Design," did not change the conclusion reached in our earlier report of April 14, 1994. We continue to believe that acceptable bases and requirements have been established in the application to assure that the U.S. ABWR Standard Design can be used to engineer and construct plants that with reasonable assurance can be operated without undue risk to the health and safety of the public.

Background and Discussion

We have been involved in the review of the U.S. ABWR design since GENE applied for certification. This review was carried out in accordance with 10 CFR Part 52, which requires ACRS to report on those portions of 10 CFR Part 52 applications that concern safety. In our April 14, 1994 report to the Commission, we supported the certification of the U.S. ABWR design. This report was included in the staff Safety Evaluation Report (NUREG-1503). The present review is intended to supplement our earlier review of this ABWR application.

Sincerely,

A handwritten signature in cursive script, reading "T. S. Kress", is written over the typed name.

T. S. Kress
Chairman

References:

1. U. S. Nuclear Regulatory Commission, NUREG-1503, Supplement No. 1, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design," dated July 1, 1996
2. Staff Requirements Memorandum dated June 11, 1996, from John C. Hoyle, Secretary, to John T. Larkins, ACRS, regarding meeting with Advisory Committee on Reactor Safeguards, May 24, 1996
3. ACRS Report dated April 14, 1994, from T. S. Kress, Chairman, ACRS, to Ivan Selin, Chairman, NRC, Subject: Report on the Safety Aspects of the General Electric Nuclear Energy Application for Certification of the Advanced Boiling Water Reactor Design
4. Letter dated April 16, 1996, from J. F. Quirk, GE Nuclear Energy, to Dennis M. Crutchfield, Nuclear Regulatory Commission, regarding ABWR design changes
5. Letter dated July 1, 1996, from J. F. Quirk, GE Nuclear Energy, to the Nuclear Regulatory Commission, Subject: ABWR Design Control Document Changes



22 CONCLUSION

The NRC staff performed its review of changes made to the U.S. ABWR design documentation by GE Nuclear Energy in its letters dated June 10 and July 1, 1996 and other changes made to conform the U.S. ABWR Design Control Document (DCD) to the final design certification rules. The design changes were reviewed by the Advisory Committee on Reactor Safeguards as described in Chapter 21 of this report. On the basis of the evaluation described in NUREG-1503 and this report, the NRC staff concludes that the confirmatory issues in NUREG-1503 are resolved, the changes to the ABWR design documentation are acceptable, and GE's application for design certification meets the requirements of Subpart B to 10 CFR Part 52 that are applicable and technically relevant to the U.S. ABWR design.



Appendix C

CONTINUATION OF CHRONOLOGY OF CORRESPONDENCE

This appendix contains an update of the chronological list of routine licensing correspondence in Appendix C of NUREG-1503. The correspondence is between the U.S. Nuclear Regulatory Commission (NRC) staff and GE regarding the review of the Advanced Boiling Water Reactor (ABWR) under Project 671 and Docket Numbers 50-605 and 52-001. Correspondence regarding the ABWR design certification rulemaking is not included here, but may be found in the rulemaking records.

July 20, 1994	Jack N. Fox, GE, Forwards Revision 7 to ABWR SSAR and Revision 6 to CDM Fiche: 80480-222/80480-297 acn: 9407220186
July 25, 1994	Dennis M. Crutchfield, NRC, Letter responding to NEI letters of 6/24/94 and 6/23/94 Fiche: 80755-297/80755-297 acn: 9409010086
July 28, 1994	Thomas H. Boyce, NRC, Summary of meeting on 7/12/94 to discuss preparation of the ABWR Design Control Document Fiche: 80473-136/80473-151 acn: 9408050011
July 31, 1994	Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design, Vol. 1 Fiche: 80681-001/80683-148 acn: 9408260011
July 31, 1994	Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design, Vol. 2 Fiche: 80659-098/80659-306 acn: 9408250023
August 2, 1994	Jack N. Fox, GE, Forwards ten copies of draft ABWR Design Control Document Fiche: 80563-001/80564-030 acn: 9408120078
August 3, 1994	Jack N. Fox, GE, Forwards Chapter 21 17x22 inch drawings to replace temporary 11x17 drawings provided in 6/23/94 letter Fiche: 80589-340/80589-342 acn: 9408150260
August 3, 1994	Dennis M. Crutchfield, NRC, Updates guidance on preparation of design control document contained in 8/26/93 NRC letter Fiche: 80489-199/80489-202 acn: 9408080093
August 12, 1994	Joseph F. Quirk, GE, Letter regarding fee regulations for design certification Fiche: 80626-356/80626-356 acn: 9408180170
August 23, 1994	Thomas H. Boyce, NRC, Forwards staff comments on sections of the draft Design Control Document (DCD) for the Advanced Boiling Water Reactor (ABWR) Fiche: 80692-254/80692-283 acn: 9408290030

August 25, 1994	R.W. Borchardt, NRC, Letter forwarding ten copies of ABWR FSER, NUREG-1503 (Vol. 1 & 2) Fiche: 80728-284/80728-287 acn: 9408300058
August 30, 1994	Joseph F. Quirk, GE, Submittal of revision to draft Introduction to the Design Control Document (DCD) Fiche: 80841-001/80841-016 acn: 9409090214
September 7, 1994	Joseph F. Quirk, GE, Forwards Rev 0 to "Advanced BWR Design Control Document." Fiche: 81150-010/81182-010 acn: 9409190302
September 8, 1994	Thomas H. Boyce, NRC, Summary of Meeting on 8/23/94 to Discuss Staff Comments on Sections of the Draft Design Control Document (DCD) Fiche: 80936-098/80936-099 acn: 9409160074
September 20, 1994	Joseph F. Quirk, GE, Letter requesting that FDA for the ABWR be issued for a period of fifteen years Fiche: 83349-352/83349-356 acn: 9503290326
September 27, 1994	Dennis M. Crutchfield, NRC, Letter informing GE of results of review of the Design Control Document (DCD) for the Advanced Boiling Water Reactor (ABWR). Identified multiple discrepancies. Fiche: 81078-355/81078-356 acn: 9409300084
October 4, 1994	R.W. Borchardt, NRC, Forwards staff comments on the Introduction to the Design Control Document (DCD) Fiche: 81245-350/81245-356 acn: 9410110200
October 5, 1994	Joseph F. Quirk, GE, Letter discussing root cause and corrective measures for unidentified changes in the Design Control Document (DCD) Fiche: 81363-302/81363-304 acn: 9410180178
October 13, 1994	Joseph F. Quirk, GE, Letter regarding GE being designated as the source for the DCD in the ABWR notice of proposed rulemaking Fiche: 83349-351/83349-351 acn: 9503290330

October 20, 1994 William T. Russell, NRC, Letter responding to NEI letter of 9/20/94 to Chairman Selin, discussing proposed design certification rules for ABWR and System 80+
Fiche: 81454-190/81454-191
acn: 9410270084

October 21, 1994 David T. Tang, NRC, Summary of meeting on 10/06/94 on the ABWR Design Control Document (DCD)
Fiche: 81444-356/81444-360
acn: 9410260214

October 28, 1994 Joseph F. Quirk, GE, Forwards Rev 0 to "ABWR Design Control Document (DCD)." DCD comprised of introduction, certified design material & approved safety analysis material. Responses to NRC comments requested by 9/27/94 letter also enclosed.
Fiche: 81680-001/81695-360
acn: 9411020070

November 1, 1994 Steven P. Frantz, GE, Forwards description of proposed process for controlling changes to severe accident evaluations & explains bases for proposed process.
Fiche: 81752-339/81752-352
acn: 9411140186

November 1, 1994 Thomas H. Boyce, NRC, Summary of meeting on 9/27-28/94 to discuss staff comments on draft DCD for the ABWR.
Fiche: 81622-001/81622-161
acn: 9411070271

November 2, 1994 Dennis M. Crutchfield, NRC, Response to GE letter of 10/13/94 regarding designated source for the ABWR DCD in notice of proposed rulemaking
Fiche: 81658-178/81658-180
acn: 9411080085

November 4, 1994 S.P. Frantz, GE, Forwards proposed revision to Section 3.8 of DCD Introduction for ABWR regarding GE meeting on 11/02/94
Fiche: 81075-357/81075-358
acn: 9411140188

November 15, 1994 Thomas H. Boyce, NRC, Summary of meeting on 941102 to discuss treatment of severe accidents in the Design Control Document (DCD)
Fiche: 81822-303/81822-307
acn: 9411220426

November 18, 1994 Joseph F. Quirk, GE, Forwards NEPA/SAMDA submittal for the ABWR. Attachment contains Technical Support Document for the ABWR
Fiche: 83349-281/83349-350
acn: 9503290334

November 23, 1994 William T. Russell, NRC, Forwards revised final design approval (FDA) for the ABWR
Fiche: 81849-332/81849-337
acn: 9411250204

December 8, 1994	R.W. Borchardt, NRC, Forwards staff comments on Revision 0 of ABWR Design Control Document. Fiche: 82061-157/82061-263 acn: 9412190091
December 16, 1994	N.E. Garber, "Plain Carbon Steel." Fiche: 82144-330/82144-345 acn: 9412270184
December 21, 1994	Joseph F. Quirk, GE, Forwards NEPA/SAMDA submittal for the ABWR. Attachment contains Revision 1 to the Technical Support Document (TSD) Fiche: 83349-216/83349-280 acn: 9503290339
December 22, 1994	Joseph F. Quirk, GE, Closure of ABWR FSER Confirmatory Items Fiche: 83353-001/83353-003 acn: 9503290346
December 22, 1994	Joseph F. Quirk, GE, Submittal of Revision 1 to the ABWR Design Control Document Fiche: 82126-001/82127-225 acn: 9412280096
January 17, 1995	Jack N. Fox, GE, Submittal of Revision 2 to the ABWR Design Control Document Fiche: 82484-281/82484-346 acn: 9501230195
January 26, 1995	Jack N. Fox, GE, Provides information for closure of ABWR FSER Confirmatory Item F1.2.2-2 previously addressed in 12/22/94 letter Fiche: 82616-278/82616-279 acn: 9502020103
March 16, 1995	R.W. Borchardt, NRC, Forwards environmental assessment (EA) for ABWR design certification and severe accident mitigation design alternatives (SAMDA)s Fiche: 83238-272/83238-293 acn: 9503240250
May 31, 1995	Jack N. Fox, GE, Forwards revised effective pages listing for ABWR DCD Fiche: 82484-281/82484-346 acn: 9501230195
February 7, 1996	Dennis M. Crutchfield, NRC, Discusses resolution of confirmatory items in NUREG-1503 regarding ABWR Fiche: 87081-079/87081-080 acn: 9602090004
March 22, 1996	Joseph F. Quirk, GE, Submittal of Amendment 36 (Revision 8) to the ABWR SSAR, and Revision 7 to the CDM Fiche: 87680-001/87680-238 acn: 960328189

April 3, 1996

Joseph F. Quirk, GE, Forwards marked up proposed changes to ABWR design description

Fiche: 88175-109/88175-113

acn: 9605080030

April 16, 1996

Joseph F. Quirk, GE, Forwards proposed changes to ABWR DCD developed during first-of-a-kind-engineering (FOAKE)

Fiche: 88077-001/88007-146

acn: 9604240082

April 25, 1996

Brian K. Grimes, NRC, Discusses review of changes to ABWR design documentation in GE letter of 4/16/96

Fiche: 88046-355/88046-358

acn: 9604290399

April 26, 1996

Joseph F. Quirk, GE, Forwards responses to staff letter regarding ABWR DCD change package

Fiche: 88175-185/88175-186

acn: 9605080090

May 8, 1996

Thomas H. Boyce, NRC, Summary of meeting on 5/1/96 to discuss changes to the ABWR Design Control Document (DCD)

Fiche: 88270-163/88270-261

acn: 9605150239

June 10, 1996

Joseph F. Quirk, GE, Forwards changes to ABWR design documentation

Fiche: 89075-163/89075-312

acn: 9607190012

August 30, 1996

Joseph F. Quirk, GE, Forwards ABWR DCD, Revision 3, ABWR CDM, Revision 8, and ABWR SSAR Amendment 37, Revision 9

Fiche: 89647-001/89649-180

acn: 9609090224

ABWR DESIGN CONTROL DOCUMENT (DCD) REVISIONS

DCD REVISIONS	DATE
Revision 0	10/28/94
Revision 1	12/22/94
Revision 2	1/17/95
Revision 3	8/30/96
Revision 4	3/28/97

ABWR CERTIFIED DESIGN MATERIAL (CDM) REVISIONS

CDM REVISIONS	DATE
Revision 0	8/31/92
Revision 1 (submitted with SSAR Amendment 32)	9/17/93
Revision 2 (submitted with SSAR Amendment 33)	12/7/93
Revision 3 (submitted with SSAR Amendment 34)	3/31/94
Revision 4 (submitted with SSAR Amendment 35)	5/25/94
Revision 5 (submitted with SSAR Amendment 35 modification package (SSAR Revision 6))	6/23/94
Revision 6 (submitted with SSAR Amendment 35 modification package (SSAR Revision 7))	7/20/94
Revision 7 (submitted with SSAR Amendment 36)	3/22/96
Revision 8 (submitted with SSAR Amendment 37)	8/30/96

ABWR STANDARD SAFETY ANALYSIS REPORT (SSAR) AMENDMENTS

AMENDMENTS	DATE	AMENDMENTS	DATE
1	3/29/88	19	12/13/91
2	6/29/88	20 Drawings	3/13/92 4/8/92
3	12/30/88	21 Drawings Modification package	7/6/92 7/13/92 7/22/92
4	1/31/89	22 Drawings	9/18/92 9/21/92
5	2/28/89	23	11/20/92
6	3/31/89	24	1/7/93
7	6/2/89	25	1/29/93
8	7/28/89	26	3/24/93
9	11/17/89	27	4/23/93
10	3/28/90	28	5/14/93
11	5/2/90	29	5/28/93
12	6/4/90	30	7/8/93
13	7/3/90	31 (Revision 1)	7/28/93
14	10/2/90	32 (Revision 2) Modification package	9/17/93 9/27/93
15	11/30/90	33 (Revision 3) Modification package	12/7/93 12/13/94
16	2/22/91 4/16/91 drawings	34 (Revision 4) Modification package	3/31/94 4/11/94
17	6/28/91	35 (Revision 5) Modification package (Revision 6) Modification package (Revision 7)	5/25/94 6/23/94 7/20/94
18	10/11/91	36 (Revision 8)	3/22/96
		37 (Revision 9)	8/30/96



Appendix D

CONTRIBUTORS TO THIS FSER SUPPLEMENT

<u>NAME</u>	<u>RESPONSIBILITY</u>
Thomas Boyce	Project Manager
Bernard Bordenick	Legal Review
William Burton	Plant Systems
Matthew Chiramal	Instrumentation and Controls
Angela Chu	Technical Specifications
Richard Emch	Radiological Analyses
George Georgiev	Materials Engineering
Jeff Holmes	Fire Protection
Jay Lee	Radiological Analyses
James Lyons	Section Chief, Plant Systems
Janice Moore	Legal Review
John Monninger	Containment Systems and Severe Accidents
Roger Pedersen	Radiation Protection
Janak Raval	Plant Systems
Nicholas Saltos	Probabilistic Risk Assessment
Dino Scaletti	Senior Project Manager
James Stewart	Instrumentation and Controls
Frank Talbot	Initial Test Program and Reliability Assurance
Dale Thatcher	Electrical Engineering
George Thomas	Reactor Systems
Jerry Wilson	Senior Policy Analyst
Ron Young	Plant Systems



Appendix L

ERRATA TO THE ABWR FSER

Page, Column, Paragraph

Page 1-1, 1st column, 3rd paragraph

Change

Delete the sentence beginning with "Amendment 35", and replace it with "Amendment 35 (Revisions 5, 6 and 7), the last revision of which was submitted to the Commission on July 20, 1994, was the last amendment." Also, delete the sentence "GE submitted Revision 4 to the CDM on May 25, 1994.", and replace it with "CDM Revision 6, submitted to the Commission on July 20, 1994, was the last revision to the CDM."

Page 1-1, 1st column, 4th paragraph

In the first sentence, add the phrase "(Revisions 5, 6 and 7)" after "Amendment 35." Also change the CDM revision from "Revision 4" to "Revision 6."

Page 1-4, 1st column, 3rd paragraph

Delete the phrase "the core spray."

Page 1-7, 2nd column, 1st paragraph

Change "...NRC review and approval" to "NRC approval"

Page 2-11, Table 2-2

Change the values for LPZ Chi/Q to the following:

0-8 hours	1.56E-4
8-24 hours	9.61E-5
1-4 days	3.36E-5
4-30 days	7.42E-6

Page 3-37, 2nd column, 2nd paragraph

Change "RG 1.61" to "RG 1.60."

Page 3-38, 2nd column, 3rd paragraph

Add parentheses around the phrase "the RG 1.60 shapes anchored to 0.3g peak ground accelerations" and delete the word "and" in front of that phrase.

Page 3-42, 1st column, 2nd paragraph

In line 4, change "25.9m (85 ft)" to "25.7m (84.3 ft)."

Page 3-42, 2nd column, 1st paragraph

In line 6, change "25.9m (85 ft)" to "25.7m (84.3 ft)."

Page 3-43, 2nd column, 1st paragraph

Change "(Case RZU)" to "(Case R2U)."

Page 3-50, 1st column, 1st paragraph

Change "...would involve an unreviewed safety question and, therefore, require NRC review and approval prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Furthermore, any requested change..."

Page 3-50, 1st column, 3rd paragraph

In line 2, Change "...finger pin closure," to "...flanged closure," Also, in line 3, change "...was analyzed..." to "...will be analyzed...", and in line 8 change "...were evaluated." to "...will be evaluated."

Page 3-50, 2nd column, 1st paragraph

Change "...would involve an unreviewed safety question and, therefore, require NRC review and approval prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Furthermore, any requested change..."

Page 3-52, 1st column, 4th paragraph

Change the second sentence to read "... finite element method will be used for the analysis and the design will be accomplished ...".

Page 3-53, 2nd column, last paragraph	Change "...would involve an unreviewed safety question and, therefore, require NRC review and approval prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Furthermore, any requested change..."
Page 3-55, 2nd column, 2nd paragraph	Change "NASTRAN" to "STARDYNE" computer code.
Page 3-57, 1st column, 3rd paragraph	Change "...would involve an unreviewed safety question and, therefore, require NRC review and approval prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Furthermore, any requested change..."
Page 3-80, 1st column, 2nd paragraph	Change "...would involve an unreviewed safety question and, therefore, require NRC review and approval prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Furthermore, any requested change..."
Page 3-87, 2nd column, 2nd paragraph	Change "...would involve an unreviewed safety question and, therefore, require NRC review and approval prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Furthermore, any requested change..."
Page 3-123, 2nd column, last paragraph	Change "...would involve an unreviewed safety question and, therefore, require NRC review and approval prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Furthermore, any requested change..."
Page 4-1, 2nd column, 3rd paragraph	In the first sentence, change "...prior NRC review and approval." to "...prior NRC approval."
Page 4-2, 2nd column, 3rd paragraph	Change "...with NRC review and approval." to "...with prior NRC approval."
Page 4-3, 1st column, last paragraph	In the second sentence, change "...with NRC review and approval." to "...with prior NRC approval."
Page 6-12, 2nd column, 3rd paragraph	In line 3, change "swell" to "condensation."
Page 6-39, 2nd column, 1st paragraph	Change "(150 psig)" to "(150 psia)."
Page 6-39, 2nd column, 4th paragraph	Modify the sentence beginning with "SSAR Table 6.3-1 ..." to read "SSAR Table 6.3-1 states that the rated HPCF flow of 12,113 L/min (3,200 gpm) will be attained at a differential pressure (between the reactor vessel and the air space of the compartment containing the water source for the pump) of approximately 689 kPad (100 psid), ...".
Page 6-41, 1st column, 2nd paragraph	In line 3, after "...primary containment...", add "(except the Low Pressure Flooder Loop A check valve which is outside containment because it is connected to the feedwater line)"

Appendix L

Page 6-53, 2nd column, 2nd paragraph

Replace the paragraph with the following: "The HPIN system has both non-safety-related and safety-related portions. The non-safety-related portion provides a continuous nitrogen supply to all pneumatically operated components in the primary containment during normal operation. This nitrogen is supplied by the nitrogen gas evaporator/storage tank via the makeup line from the ACS. The safety-related portion has two independent divisions. Each division contains a safety-related emergency stored nitrogen supply capable of supplying 100 percent of the requirements of the division being serviced. Normally, nitrogen gas for the safety-related portion is also supplied by the nitrogen gas evaporator/storage tank via the makeup line from the ACS. If that supply is not available, then it will be supplied from HPIN gas storage bottles. There are tielines between the non-safety-related portion and each division of the safety-related portion. Each tieline has a motor-operated shutoff valve."

Page 7-1, 1st column, 3rd paragraph

Change "Chapter 1 ..." to "Chapter 21 ...".

Page 7-13, 1st column, 1st paragraph

In the indented paragraph, change "...would involve an unreviewed safety question and, therefore, require NRC review and acceptance prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Any requested changes..."

Page 7-13, 2nd column, 3rd paragraph

Change "... GE NUMARC ..." to "...GE NUMAC ...".

Page 7-19, 2nd column, 4th paragraph

Change "For manual scram, ..." to "For manual trip test, ...".

Page 7-22, 1st column, 2nd paragraph

Change "MPL ABBE-4080 ..." to "MPL-A32-4080 ...". Also, change "... shall be a synchronous between ..." to "... shall be asynchronous between..."

Page 7-23, 1st column, 1st paragraph

Change "...would involve an unreviewed safety question and, therefore, require NRC review and acceptance prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Any requested changes..."

Page 7-27, 1st column, 2nd paragraph

Change "...would involve an unreviewed safety question and, therefore, require NRC review and acceptance prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Any requested changes..."

Page 7-27, 2nd column, 5th paragraph

Change "Figure 7.A.2.1 in SSAR Appendix 7A shows ..." to "Table 7A-1 in SSAR Appendix 7A lists ...". Also change "This drawing was listed ..." to "This table was listed ...".

Page 7-28, 1st column, 5th paragraph

Change "There are a total of 21 input channels ..." to "There are nominally a total of 21 input channels ...".

Page 7-28, 2nd column, 1st paragraph

In subparagraphs a. - d., change "interface boards" to "interfaces".

Page 7-29, 1st column, 2nd paragraph

Change "Section 7.1.2.6" to "Section 7.1.2.1.6."

Page 7-29, 2nd column, 1st paragraph

In subparagraph 1., change "one set of scram pilot valve solenoids" to "one half of the scram pilot valve solenoids."

Page 7-30, 1st column, 2nd paragraph	Change "...would involve an unreviewed safety question and, therefore, require NRC review and acceptance prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Any requested changes..."
Page 7-32, 1st column, 1st paragraph	Change "Division III 480 Vac source" to "Division II 480 Vac source."
Page 7-32, 1st column, 4th paragraph	In the last two lines, change "The ABWR design requires the coils of both scram pilot solenoid valves of each CRD ..." to "The ABWR design requires both coils of the scram pilot solenoid valve of each CRD ...".
Page 7-32, 2nd column, 2nd paragraph	Change "Portions of the RPS and SSLC (in particular, the RMUs) are located ..." to "Portions of the RPS and the RMUs are located ...". Also, delete the word "control" from "control building" in the sentence.
Page 7-33, 2nd column, 2nd paragraph	In subparagraph 1., change "commonality" to "correlation" and "an error" to "a common-cause error."
Page 7-34, 1st column, 2nd paragraph	Change "DTM" to "logical."
Page 7-41, 2nd column, last paragraph	Change "...would involve an unreviewed safety question and, therefore, require NRC review and acceptance prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Any requested changes..."
Page 7-42, 2nd column 2nd paragraph	Change "Table 7B.1" to "Appendix 7B."
Page 7-44, 1st column, 4th paragraph	Change "...would involve an unreviewed safety question and, therefore, require NRC review and acceptance prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Any requested changes..."
Page 7-44, 2nd column, last paragraph	Change "...would involve an unreviewed safety question and, therefore, require NRC review and acceptance prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Any requested changes..."
Page 7-45, 1st column, 2nd paragraph	Change "DMH-4270" to "H23-4010."
Page 7-46, 1st column, 4th paragraph	Change "...would involve an unreviewed safety question and, therefore, require NRC review and acceptance prior to implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Any requested changes..."
Page 7-48, 1st column, 3rd paragraph	Change each "and" in the paragraph to "or" in all 5 places where it occurs.
Page 7-51, 2nd column, 3rd paragraph	Change "reactor flow control" to "recirculation flow control." Also change "dome pressure and low reactor" to "dome pressure or low reactor."
Page 7-52, 1st column, 3rd paragraph	Change the last sentence to read "The ARL initiation variables in the RFC system also initiate a ...".

Appendix L

Page 7-56, 2nd column, 3rd paragraph

Change the first sentence to read "Three SRNM channels per division provide input to each of SSLC Divisions I and III, and two SRNM channels per division provide input to each of SSLC Divisions II and IV."

Page 7-57, 1st column, 3rd paragraph

After the sentence ending in "... IEEE-279-1971," add "The OPRM is a functional subsystem of the APRM. Each OPRM receives the identical LPRM signals from the corresponding APRM channels as inputs."

Page 7-57, 1st column, 4th paragraph

In the second sentence, put a period after the word "function" and delete the remainder of the sentence. Also, delete the sentence beginning with "The SRI function ...". Also, after the phrase "... four separate inputs," insert "(combined with other APRM trip outputs)."

Page 7-58, 1st column, 5th paragraph

Delete the first three sentences and replace with "The SPTM system is a four division system consisting of temperature sensors at eight sensor locations around the circumference of the suppression pool, with two groups of sensors at each sensor location. Each group has four sensors located at different elevations in the suppression pool. The signal processing for the SPTM system is performed by EMS and SSLC microprocessors, which are powered by four divisionally separated electrical buses."

Page 7-60, 1st column

In the title for section 7.7.1.5, change "Generator" to "Generation."

Page 8-1, 2nd column, 4th paragraph

Change "gas turbine generator" to "combustion turbine generator."

Page 8-5, 2nd column, 4th paragraph

In the second sentence, delete the phrase "routed on opposite sides of the room and will be."

Page 8-13, 2nd column, 2nd paragraph

Change the sentence beginning with "Simultaneously, ..." to read "Simultaneously, a timer will be started, allowing the operator to take necessary corrective action (The actual set points will be established as part of an overall system voltage and load analysis)." Also modify the following sentence to read "After the time delay, the feeder breaker affected by the degraded voltage will be tripped."

Page 8-14, 1st column, 2nd paragraph

In the bulletized section, delete the phrase "for 5 minutes with voltages at the load at 70 percent of the nominal voltage rating", and insert the phrase "for degraded voltages below 90% for the time period established in the load analysis for the degraded voltage protective time delay."

Page 9-4, 1st column, 2nd paragraph

Change the sentence that begins with "Specifically, the system includes two ..." to read "Specifically, the system includes two 100 percent capacity circulating pumps, two 50 percent capacity heat exchangers, two 100% filter/demineralizers, two post demineralizer strainers, ...".

Page 9-6, 1st column, 1st paragraph

Delete the prefix "non-" from "non-safety-related suction portion."

Page 9-22, 1st column, 2nd paragraph

In the last sentence, change "train" to "section."

Page 9-23, 1st column, 1st paragraph

At the end of the sentence add "... and with a design UHS temperature of 35 °C (95 °F)."

Page 9-24, 1st column, 4th paragraph

Delete the phrase ", the portions of the system that are part of the secondary containment boundary,".

Page 9-26, 1st column, 1st paragraph	In line 6, change ".....of one refrigerator and pump, a surge tank..." to "...of two refrigerators and two pumps, a surge tank..."
Page 9-26, 2nd column, 1st paragraph	In the last sentence, change "refrigerant" to "HECW system."
Page 9-28, 1st column, 4th paragraph	In the second sentence, delete the phrase "corresponding division of the."
Page 9-30, 2nd column, 2nd paragraph	In the second sentence, change "heat exchangers" to "pumps."
Page 9-33, 1st column, 6th paragraph	At the end of the sentence ending in "... safety-related portion of the system." add "in the event that nitrogen gas is not available from the ACS."
Page 9-46, 1st column, top paragraph	In line 2, change "...in which the exhaust fan is stopped, the recirculation damper is closed, and the exhaust bypass damper is opened." to "...in which both exhaust fans are started at high speed and the recirculation damper is closed."
Page 9-47, 2nd column, 2nd paragraph	In line 8, change "...closing the exhaust fan, and opening the exhaust fan bypass damper to allow..." to "...and starting both exhaust fans in conjunction with a supply fan to allow..."
Page 9-49, 2nd column, 1st paragraph	In line 10, delete "(bag-type filter)", and in line 13 delete "(bag-type)." Also, in line 14, change the sentence beginning with "The supply system..." to read "The supply system consists of three 50-percent capacity air handling units consisting of a filter, a cooling and heating coil, and supply fans,..." Also, in line 18, delete "bag-type."
Page 9-51, 1st column, 4th paragraph	In the first sentence, delete "...FCUs and four...", add a comma after the word "coil", and add "...and filter as required." to the end of the sentence. Also, in line 6, change "10" to "6."
Page 9-52, 1st column, 2nd paragraph	In line 5, put a period after the word "'fan," and delete "...and an electric heater."
Page 9-52, 1st column, 2nd paragraph	Change the DG room temperature from "below 45 °C (113 °F)" to "below 50 °C (122 °F)."
Page 9-52, 1st column, 2nd paragraph	In the sixth line from the bottom, delete the word "and," and add "...and starting the smoke removal fans in conjunction with the supply fans." to the sentence ending in "...to purge the affected area."
Page 9-53, 1st column, 1st paragraph	Change the DG room temperature from "below 45 °C (113 °F)" to "below 50 °C (122 °F)."
Page 9-65, 1st column, 1st paragraph	In line 5, put a period after the word "areas" and delete the rest of the paragraph.
Page 9-65, 2nd column, 1st paragraph	In line 2, delete "secondary containment and the." Also, in line 4 change "...these HVAC systems, they will..." to "...the HVAC system, it will..."
Page 10-2, 1st column, 2nd paragraph	In the second sentence, change "disk/pump" to "disk/dump."
Page 10-2, 1st column, 4th paragraph	In the first sentence, delete the rest of the sentence after the phrase "... will be provided" and insert "in accordance with the Boiling Water Reactor Owners Group turbine surveillance program."

Appendix L

Page 11-2, 2nd column, 2nd paragraph

In the second sentence, change "filtered in one or two" to "filtered in one of two."

Page 14-28, 1st column, 4th paragraph

Change "...would constitute an unreviewed safety question, and therefore, would require NRC review and approval prior to implementation of the change." to "...would require NRC approval prior to implementation of the change."

Page 14-30, 2nd column, last paragraph

In the first sentence, change "...would constitute an unreviewed safety question." to "...would prior NRC approval." Also, in the second sentence, change "...prior NRC review and approval." to "...prior NRC approval."

Page 14-31, 1st column, 2nd paragraph

Change "...prior NRC review and approval..." to "...prior NRC approval..."

Page 14-31, 2nd column, last paragraph

Change "basis configuration" to "basic configuration".

Page 14-37, 1st column, 2nd paragraph

Change "...would constitute an unreviewed safety question, and therefore, would require NRC review and approval prior to implementation of the change." to "...would require NRC approval prior to implementation of the change."

Page 14-37, 2nd column, 1st paragraph

Change "...would constitute an unreviewed safety question, and therefore, would require NRC review and approval prior to implementation of the change." to "...would require NRC approval prior to implementation of the change."

Page 14-40, 1st column, last paragraph

Change "...would constitute an unreviewed safety question, and therefore, would require NRC review and approval prior to implementation of the change." to "...would require NRC approval prior to implementation of the change."

Page 14-49, 2nd column, 1st paragraph

Change "... constitutes an unreviewed safety question and, therefore, must be submitted to the NRC for review and approval prior to implementation." to "...would require NRC approval prior to implementation of the change."

Page 14-52, 1st column, 3rd paragraph

Change "... constitutes an unreviewed safety question and, therefore, must be submitted to the NRC for review and approval prior to implementation." to "...would require NRC approval prior to implementation of the change."

Page 14-55, 1st column, 1st paragraph

Change "... constitutes an unreviewed safety question and, therefore, must be submitted to the NRC for review and approval prior to implementation." to "...would require NRC approval prior to implementation of the change."

Page 15-3, 1st column, 4th paragraph

In the first and last sentences, change "38 °C (68°F)" to "55.6 °C (100°F)"

Page 15-7, Section 15.4, line 8

Change "(25 rem), or a whole body dose of no more than 3000 mSv (300 rem)," to "(25 rem) whole body dose,".

Page 15-11, Table 15.3, 3rd parameter

Change the value for the mass of primary coolant released through small line from "5.5E+3 kg (1.2E+4 lb)" to "1.4E+4 kg (3.1E+4 lb)".

Page 15-12, Table 15.4, 9th parameter	Add "***" after "Standby gas treatment system" and add, at the bottom of the Table, "*** No credit given for lower flow rate after 20 minutes pressure drawdown time."
Page 15-12, Table 15.4, 13th parameter	Change the value for suppression pool water volume from "3.785E+6 m ³ (1E+6 gal)" to "3.625E+3 m ³ (9.576E+5 gal)".
Page 15-13, Table 15.6, 4th parameter	Change the value for condenser volume from "9.85E+8 cc (3.47E+4 ft ³)" to "6.23E+3 m ³ (2.2E+5 ft ³)".
Page 15-13, Table 15.6, 7th parameter	Change the value for main steamline thickness from "2.5 (1.0)" to "3.6 (1.4)" and the value for drain line length from "610 (240)" to "7160 (235)".
Page 15-14, Table 15.8, 7th parameter	Change the value for Kr-85 inventory released from damaged rods from "35%" to "30%".
Page 15-14, Table 15.8, 8th parameter	Change the values for Iodine fraction from "0.25" to "0.25%" and "0.75" to "99.75%".
Page 15-15, Table 15.9, 1st parameter	Change the value for control room free volume from "7000 m ³ (2E+5 ft ³)" to "5509 m ³ (1.95E+5 ft ³)".
Page 15-15, Table 15.9, 2nd parameter	Change the value for the following recirculation rates: filtered intake from "1.8 m ³ /sec" to "0.994 m ³ /sec"; filtered recirculation from "0.8 m ³ /sec" to "0.47 m ³ /sec"; and filter efficacy from "95%" to "99%."
Page 15-15, Table 15.9, 3rd parameter	Change "1.0 E-1 ft ³ /min" to "1.0E+1 ft ³ /min."
Page 15-15, Table 15.9, 6th parameter	<p>Add a ")" after "sectors" and change the meteorology values to the following:</p> <p>00-008 3.10E-3 sec/m³ (8.8E-5 sec/ft³)</p> <p>08-024 1.83E-3 sec/m³ (5.2E-5 sec/ft³)</p> <p>24-096 1.16E-3 sec/m³ (3.3E-5 sec/ft³)</p> <p>96-720 5.12E-4 sec/m³ (1.5E-5 sec/ft³)</p>
Page 15-15, Table 15.9, 7th parameter	Change to Iodine protection factor from "27" to "100".
Page 15-15, Table 15.9, 11th parameter	<p>Change the thyroid doses to control room personnel to the following:</p> <p>00-008 7 (0.7)</p> <p>08-024 7 (0.7)</p> <p>24-096 37 (3.7)</p> <p>96-720 52 (5.7)</p> <p>Total 103 (10.2)</p>
Page 15-16, 1st column, 2nd paragraph	Change "SSAR 15.4.9.6" to "SSAR Section 15.4.10.6".
Page 15-16, 1st column, 3rd paragraph	Change "SSAR 15.4.9.2" to "SSAR 15.4.10.2".
Page 15-16, 2nd column, 3rd paragraph	Change "5448 kg (12,000 lbs)" to "14,000 kg (30,000 lbs)" in 2 places.
Page 15-19, 1st column, 1st paragraph	Change "28 BWR sites" to "28 geological sites".

Appendix L

Page 18-28, 1st column, 2nd paragraph

Change "...by the COL applicant would involve an unreviewed safety question and, therefore, require NRC review and acceptance prior to implementation." to "...would require NRC approval before implementation." Also, delete the next sentence beginning with "Thus, any change..."

Page 18-35, 1st column, 3rd paragraph

Change "...would involve an unreviewed safety question and, therefore, require NRC review and acceptance before implementation." to "...would require NRC approval prior to implementation." Also, delete the next sentence beginning with "Any requested change..."

Page 19-6, 1st column, last paragraph

Change "3.8E-8" to "3.2E-8" in line 8.

Page 19-6, 2nd column, 2nd paragraph

Change "fussell-vesely" to "Fussell-Vesely".

Page 19-6, 2nd column, 2nd paragraph

Change "when shutdown occurs" to "during shutdown" in line 10.

Page 19-6, 2nd column, 1st paragraph

Change "The analysis identified scram function and its attendant equipment..." to "The analysis identified multiplexed safety system logic and control equipment..." in line 5.

Page 19-7, 2nd column, 1st paragraph

Change "SSAR Section 19.9" to "SSAR Section 19.8".

Page 19-8, 1st column, 2nd paragraph

Delete the word "many" in line 3.

Page 19-11, 1st column, 1st paragraph

Add "Appendix D" to the list of appendices in line 4.

Page 19-11, 2nd column, 5th paragraph

Change "RWCU" to "CUW".

Page 19-12, 1st column, 1st paragraph

In the last sentence, change "(See SSAR Section 19.9) to (See SSAR Section 19.11)

Page 19-12, 1st column, 4th paragraph

In line 2, add "or in the emergency procedure guidelines" after "(See SSAR Section 19.9)"

Page 19-12, 1st column, last paragraph

In the second sentence, change "...is documented in the table ..." to "...is documented in SSAR Section 19.8..."

Page 19-13, 1st column, top paragraph

Change "3.8E-8" to "3.2E-8" in line 4.

Page 19-13, 2nd column, 1st paragraph

In the second line, change "fussell-vesely" to "Fussell-Vesely".

Page 19-14, 1st column, 3rd paragraph

In the ninth line, change "...diverse (resulting from the..." to "diverse (compared to the..."

Pages 19-18 and 19-19, Table 19.1-7

Move or insert the "/DP*" between "LOP*" and "APW*" or "/APW*" in sequences 5, 9, 18, 20, 3, 7, 17, 19, 11, 12, 22, 24, 25, 26, 4, 6, 8, and 10. In Damage Class 1B, change the seismic HCLPF value from "0.62" to "0.60" and the seismic/random HCLPF from "None" to "0.50g * 1.6E-3" for both sequence 3 and the total. In sequences 17 and 19, delete the "**V2" at the end of the sequence description. In sequence 7 and the total, change "0.62g" to "0.60g." In sequence 11 and 12, delete the "AW*." In sequences 21, 13, 22, and 24, change "PC" to "PC/." Modify all sequence numbers by subtracting 2.

Page 19-19, LEGEND

Change "PC=Failure of SRVs to Close" to "PC=Failure of SRVs to Close Given LOP with Scram" and add "PC1=Failure of SRVs to Close Given LOP without Scram"

Page 19-20, Table 19.1-8

In Damage Class 1B-2, add "SW Pump House (0.60g) or" after "Diesel Generator (0.62g) or." Also in Damage Class 1B-2, in the second column, delete "Fire Pump (0.62g)" and add "FW Tank (0.51g) or FW Pump (0.51g) or Injection Valve (0.50g) or FW Piping (0.50g) or Manual Valve (0.50g)." Also, partition the column titled "Seismic/Random "Dominant Cut Sets" into 2 subcolumns. In Damage Class 1B-2, add "FW System (0.50g)" to the first subcolumn and "Support System (1.6E-3)" to the second subcolumn, and in Damage Class 1C, add "Fuel Assembly (0.62g)" to the first subcolumn and "SRVs Close (1.0E-1)" to the second subcolumn.

Page 19-21, Table 19.1-8

In Damage Class 1D, delete "or HPCF Pump (0.62g)" and "V2 (0.62g)." Also, in the 3 places where it occurs in Damage Classes 1D and 1A-P through 1E-P, change "Fire Pump (0.62g)" to "FW Tank (0.51g) or FW Pump (0.51g) or Injection Valve (0.50g) or FW Piping (0.50g) or Manual Valve (0.50g)." Also, change "LPCF Pump (0.56g)" to "LPCF Pump (0.62g)." In addition, in Damage Class 1V (Incl 1V-P), partition the column titled "Seismic/Random "Dominant Cut Sets" into 2 subcolumns, and add "Fuel Assembly (0.62g)" to the first subcolumn and "LPL (1.0E-2)" to the second subcolumn.

Page 19-25, 2nd column, 1st paragraph

Change "7E-9" to "2E-8" in line 4.

Page 19-25, 2nd column, 4th paragraph

Change "RSW" to "RCW" in lines 7 and 8. Also, change "2E-9" to "9E-9" in the last line.

Page 19-26, 1st column, 2nd paragraph

Change "RSW" to "RCW" in the 7th line from the bottom.

Page 19-26, 2nd column, 2nd paragraph

In the second sentence, delete "and TSW" and "in both systems", add "CWS" between "close" and "isolation." Also, in the last sentence, delete "the TSW and."

Page 19-26, 2nd column, 3rd paragraph

In line 4, change "...reactor water service water/RCW..." to "...reactor service water..." Also, in the last sentence, change "RCW" to "RSW".

Page 19-27, 1st column, 2nd paragraph

In the first sentence, delete "and TSW" and "...and the two TSW pumps..." In the second sentence, change "...trip all five pumps, and close all isolation valves in both systems." to "...trip the CWS pumps, and close all CWS isolation valves."

Appendix L

Page 19-31, 1st column, 2nd paragraph

Add to the end of the paragraph "It is unlikely to lose RPS logic power because the power for the safety system logic control is backed up by batteries."

Page 19-31, 1st column, 6th bullet

Delete "the reactor water cleanup system," in line 2.

Page 19-31, 2nd column, 3rd bullet

Change "...a feedwater pump or other pump..." to "...any of several pumps..." in line 3.

Page 19-33, 2nd column, 1st paragraph

Add "with no active heat removal" after "about 20 hours from accident initiation."

Page 19-35, 2nd column, 2nd paragraph

In the last sentence, change "...chances of a flooding a following..." to "...chances of flooding the cavity following..."

Page 19-37, 2nd column, 1st paragraph

Change "Table 19K.11-1" to "Table 19K-4".

Page 19-37, 2nd column, 2nd paragraph

Change "Table 19K.3-1" to "Table 19K-1" and change "Table 19K.3-2" to "Table 19K-2".

Page 19-38, 1st column, 2nd paragraph

In line 10, delete "...and the NRC..."

Page 19-38, 1st column, 3rd paragraph

Add the containment overpressure protection system to the last sentence.

Page 19-41, Section 19.1.3.9.2

Replace "RWCU" with "CUW" in all places where it occurs.

Page 19-41, 2nd column, 1st paragraph

In line 8, after "...is actuated." add "GE also added a remote manual shutoff valve to the CUW system inside containment to allow the operator to manually isolate the system from the control room."

Page 19-47, 1st column, 1st paragraph

In the last sentence, delete "relief valves,"

Page 19-49, 1st column, 1st paragraph

Add the phrase "If the AC independent water addition system is used, ..." to the sentence beginning with "The water from the containment spray system..."

Page 19-49, 1st column, 3rd paragraph

In the first sentence, change "will" to "may".

Page 19-51, 2nd column, 2nd paragraph

In the third sentence, change the units of minimum flow rate from "10.8 Kg" to "10.8 Kg/sec".

Page 19-54, 2nd column, 2nd-4th paragraphs

Delete the word "an" from the phrase "an uncertainty analyses" in 3 places where it occurs.

Page 19-55, 1st column, 2nd paragraph

In the last line, change "system" to "systems".

Page 19-58, 2nd column, 4th paragraph

In the third sentence, add the phrase "from the AC independent water addition system" to the end of the phrase "...from 35 to 31 hours if drywell sprays are available."

Page 19-59, 1st column, 2nd paragraph

In the fourth sentence, add the phrase "...with no active heat removal" to the end of the phrase "...on the order of 15 to 20 hours, ...".

Page 19-60, 2nd column, 2nd paragraph

Change the units from "liters/m" to "liters/min" in two places.

Page 19-70, 2nd column, last paragraph	In the fifth line, change "...should be Table..." to "...should be used in Table..."
Page 19-73, 1st column, 3rd paragraph	In the first line, change "A.2 above" to "19.2.6.2.1.2 above".
Page 19-73, 2nd column, last paragraph	In the last line, change "...Section 2D of this report." to "Section 19.2.6.2.4 of this report."
Page 19-74, 1st column, 2nd paragraph	Delete the phrase "In a facsimile dated September 7, 1993, ...". Also delete the last sentence of the paragraph.
Page 19-74, 1st column, 3rd paragraph	In the first sentence, change "five operable penetrations" to "six operable penetrations" and "two pressure unseating hatches" to "three pressure-unseating hatches." Also, in lines 5 and 10, change "three pressure-unseating hatches" to "four pressure-unseating hatches."
Page 19-74, 2nd column, first paragraph	Change "As discussed in Section 2B..." with "As discussed in Section 19.2.6.2.2..."
Page 19-76, 2nd column, 3rd paragraph	At the beginning of the paragraph, add "GE indicated that the probability of a loss of shutdown cooling due to loss of logic power (which can occur in operating BWRs if the RPS MGs trip) has been significantly reduced since the shutdown cooling isolation logic (i.e., SSLC) power is backed up by batteries. Nonetheless, ..."
Page 19-77, 2nd column, first paragraph	In the eleventh line, change "containment" to "RPV".
Page 19-78, 2nd column, first paragraph	In the fourth line, change "...in such a way." to "...in some other way."
Page 19-78, 2nd column, 3rd paragraph	In the last sentence, change "...this COL action item..." to "...COL Action Item 19.9.23..."
Page 19-79, 1st column, 3rd paragraph	In the 3rd line from the bottom, change "The staff, therefore, requires..." to "The staff's position was that it required..."
Page 19-80, 1st column, 1st paragraph	In line 2, change "the same" to "similar".
Page 19-80, 1st column, 3rd paragraph	In line 4, delete the word "the" at the end of the line.
Page 19-80, 2nd column, 1st paragraph	In the last sentence, change "RHR" to "the".
Page 19-81, 1st column, top paragraph	In line 4, add "(Section 19.9.11)" after the word "item."
Page 19-82, 1st column, 3rd paragraph	In the ninth line, add "adjacent" after "a second".
Page 19-82, 2nd column, top paragraph	In line 6, change "is" to "are."
Page 19-82, 2nd column, 2nd paragraph	In the fifth sentence, change "...more than one control rod..." to "...two adjacent control rods..."
Page 19-82, 2nd column, 3rd paragraph	In the first sentence, change "...more than one control rod..." to "...two adjacent control rods..."
Page 19-82, 2nd column, 4th paragraph	In line 8, change "...a feed pump or other pump..." to "...one of several pumps..."

Appendix L

Page 19-83, 1st column, 2nd paragraph

Change "...a second control rod..." to "...two adjacent control rods..."

Page 19-84, 1st column, 4th bullet

Add "Water in the" to the beginning of the sentence and delete "flooding level".

Page 19-87, 1st column, 3rd paragraph

In the last sentence, change "...this COL action item..." to "...COL Action Item 19.9.25..."

Page 19-88, 1st column, 2nd paragraph

In the last sentence, change "...this COL action item..." to "...COL Action Item 19.9.11..."

Page 19-88, 1st column, last paragraph

In line 12, change "...reduced inventory..." to "...shutdown..."

Page 20-47, 1st column, last paragraph

Change the maximum snowload from "2.354 kPa (.341 psi)" to "2.394 kPa (0.35 psi)".

Page 20-78, 1st column, 4th paragraph

Change "...SSAR Table 19P-1." to "...Attachment A of the "Technical Support Document (TSD) for the GE ABWR," Revision 1, dated December 1994, in Table A-1. The TSD was submitted to the staff in a letter from GE to the NRC of December 21, 1994."

Page 20-79, Note 1

Change "...SSAR Table 19P-1." to "...TSD Table A-1."

Page 20-81, 1st column, 2nd paragraph

Change "...SSAR Table 19P-3." to "...TSD Table A-3."

Page 20-81, 1st column, 4th paragraph

Change "... (SSAR Table 19P-3)..." to "... (TSD Table A-3)..."

Page 20-81, 2nd column, 4th paragraph

Change "...SSAR Sections 19P.3 and 19P.4, ..." to "...TSD Sections A-3 and A-4, ..."

Page 20-82, Table 20.5.1-3

Item 1c., change the Cost/Person-Sievert Averted value for improved maintenance procedures/manuals from "1880 (18.8)" to "1870 (18.7)".

Page 20-82, Table 20.5.1-3

Item 2a., change the Person-Sievert Averted value for passive high pressure system from "0.00138 (0.138)" to "0.00069 (0.069)", and the Cost/Person-Sv Averted value from "1270 (12.7)" to "2530 (25.3)".

Page 20-82, Table 20.5.1-3

Item 3b., change the Person-Sievert Averted value for increased containment pressure capacity from "0.00020 (0.02)" to "0.0016 (0.16)".

Page 20-82, Table 20.5.1-3

Item 3c., change the Person-Sievert Averted value for improved vacuum breakers from "0.0000003 (0.00003)" to "0.0000004 (0.00004)".

Page 20-82, Table 20.5.1-3

Item 7a., change the Cost/Person-Sv Averted value for drywell head flooding from "1700 (1.7)" to "170 (1.7)".

Page 20-82, Table 20.5.1-3

Item 9b., change the Cost/Person-Sv Averted value for alternate pump power source from "1740 (17.4)" to "1730 (17.3)".

Page 20-82, Table 20.5.1-3

Item 13a., change the Cost/Person-Sv Averted value for reactor building sprays from "5900 (5.9)" to "590 (5.9)".

Page 20-84, 2nd column, 1st paragraph

Change "...SSAR Section 19P.4, ..." to "...TSD Section A.4, ...".

Page 20-84, 2nd column, 2nd paragraph	Change "...3E-7 person-Sv (0.00003 person-rem)." to "...4E-7 person-Sv (0.00004 person-rem)."
Page 20-85, Table 20.5.1-4	Change the Person-Sv averted value for passive high pressure system from "0.00138 (0.138)" to "0.00069 (0.069)".
Page 20-85, Table 20.5.1-4	Change the Person-Sievert Averted value for increased containment pressure capacity from "0.00020 (0.02)" to "0.0016 (0.16)".
Page 20-85, Table 20.5.1-4	Change the Person-Sv averted value for improved vacuum breakers from "0.0000003 (0.00003)" to "0.0000004 (0.00004)".
Page 20-87, 1st column, 1st paragraph	Change "...SSAR Section 19P.1.3." to "...TSD Section A.1.3.1." Also, change "...SSAR Section 19P.5..." to "...TSD Section A.5..."
Pages B-12 to B-15	Reorder the listed Regulatory Guides in numerically ascending order.
Page C-1	Replace the entire page with Pages C-1 through C-3 of this supplement.
Page C-25, first entry	Delete the first entry.
Page C-46	In the 3rd entry dated May 5, 1992, change "J. Duncon" to J. Duncan." Also, delete the last entry on the page regarding a May 18, 1992 letter from C.B. Brinkman.
Page C-117, 3rd entry	Change "SSAR Amendment 5" to "SSAR Amendment 35".
Page C-117, 6th entry	Insert the Fiche number "80331:057-80331:083".
Page D-1	Add "C. Thomas, Electrical Engineering", "R. Pichumani, Geoscience", and "C. Li, Plant Systems" to the list of FSER contributors.
Page E-2, 1st column, 1st paragraph	Change "NE-3322.6" to "NE-3324.8".
Page K-1, 1st column, last paragraph	In the eleventh line, change the note to read "EDGs cannot power condensate or feed pumps; CTGs cannot power feedwater pumps".
Page K-1, 1st column, last paragraph	In the last line, add "(Section 19.9.19)" after "COL applicant".
Page K-3, 2nd column, last paragraph	In the last sentence, change "...the circulating water and turbine service water pumps and close isolation valves in both systems." to "...the circulating water pumps and close CWS isolation valves." Also add "They will also alert the operators to other floods from TSW".
Page K-4, 1st column, last paragraph	In the last sentence, change "...the circulating water and turbine service water pumps and close isolation valves in both systems." to "...the circulating water pumps and close CWS isolation valves. The TSW system must be isolated manually within one hour to prevent the water from reaching safety equipment."

Appendix L

Page K-7, 1st column, 2nd paragraph

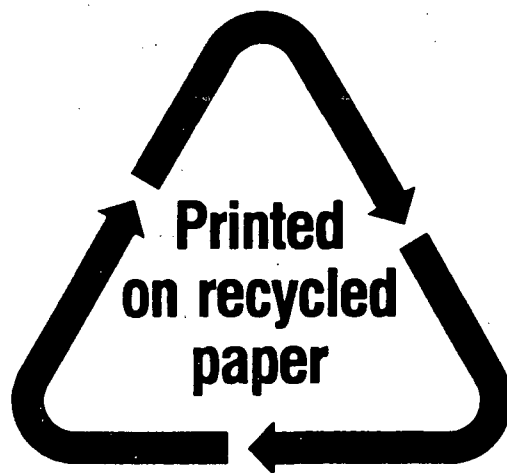
In subparagraph (2) pertaining to SRVs, insert a period after "...Class 2" and create a new subparagraph (3) with the remainder of the subparagraph.

Page K-7, 1st column, 4th paragraph

In subparagraph (2) pertaining to LOCAs outside containment, change "RWCU" to "CUW".



NRC FORM 335 (2-89) NRCM 1102, 3201, 3202	U.S. NUCLEAR REGULATORY COMMISSION BIBLIOGRAPHIC DATA SHEET <i>(See instructions on the reverse)</i>	1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.) <div style="text-align: center;">NUREG-1503 Supplement No. 1</div>				
2. TITLE AND SUBTITLE Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design Supplement No. 1		3. DATE REPORT PUBLISHED <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">MONTH</td> <td style="width: 50%; text-align: center;">YEAR</td> </tr> <tr> <td style="text-align: center;">May</td> <td style="text-align: center;">1997</td> </tr> </table>	MONTH	YEAR	May	1997
MONTH	YEAR					
May	1997					
5. AUTHOR(S)		4. FIN OR GRANT NUMBER 6. TYPE OF REPORT <div style="text-align: center;">Regulatory</div>				
8. PERFORMING ORGANIZATION - NAME AND ADDRESS <i>(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)</i> Division of Reactor Program Management Office of Nuclear Reactor Regulation U.S. Nuclear Regulatory Commission Washington, DC 20555-0001		7. PERIOD COVERED <i>(Inclusive Dates)</i> August 1994-April 1997				
9. SPONSORING ORGANIZATION - NAME AND ADDRESS <i>(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)</i> Division of Reactor Program Management Office of Nuclear Reactor Regulation U.S. Nuclear Regulatory Commission Washington, DC 20555-0001						
10. SUPPLEMENTARY NOTES Pocket Nos. 52-001 and STN 50-605; Project No. 671						
11. ABSTRACT <i>(200 words or less)</i> <p>This report supplements the final safety evaluation report (FSER) for the U.S. Advanced Boiling Water Reactor (ABWR) standard design. The FSER was issued by the U.S. Nuclear Regulatory Commission (NRC) staff as NUREG-1503 in July 1994 to document the NRC staff's review of the U.S. ABWR design. The U.S. ABWR design was submitted by GE Nuclear Energy (GE) in accordance with the procedures of Subpart B to Part 52 of Title 10 of the Code of Federal Regulations. This supplement documents the NRC staff's review of the changes to the U.S. ABWR design documentation since the issuance of the FSER. GE made these changes primarily as a result of first-of-a-kind-engineering (FOAKE) and as a result of the design certification rulemaking for the ABWR design. On the basis of its evaluation, the NRC staff concludes that the confirmatory issues in NUREG-1503 are resolved, that the changes to the ABWR design documentation are acceptable, and that GE's application for design certification meets the requirements of Subpart B to 10 CFR Part 52 that are applicable and technically relevant to the U.S. ABWR design.</p>						
12. KEY WORDS/DESCRIPTORS <i>(List words or phrases that will assist researchers in locating the report.)</i> Advanced Boiling Water Reactor (ABWR) GE Nuclear Energy (GE) Final Safety Evaluation Report (FSER) Design Certification (DC) Final Design Approval (FDA) 10 CFR Part 52		13. AVAILABILITY STATEMENT <div style="text-align: center;">unlimited</div>				
		14. SECURITY CLASSIFICATION <i>(This Page)</i> <div style="text-align: center;">unclassified</div>				
		<i>(This Report)</i> <div style="text-align: center;">unclassified</div>				
		15. NUMBER OF PAGES				
		16. PRICE				



Federal Recycling Program



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

FIRST CLASS MAIL
POSTAGE AND FEES PAID
USNRC
PERMIT NO. G-67

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, \$300

